

SECTION 16361

SECONDARY UNIT SUBSTATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes indoor secondary unit substations, each consisting of the following:
 - 1. Primary incoming section.
 - 2. Transformer.
 - 3. Secondary Transition Section.
- B. Related Sections include the following:
 - 1. Division 16 Section "Medium-Voltage Cables" for requirements of terminating cables in incoming section of substation.

1.3 DEFINITIONS

- A. NETA ATS: Acceptance Testing Specification.

1.4 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
 - 2. Dimensioned plans and elevations showing major components and features.
 - 3. One-line diagram.
 - 4. List of materials.
 - 5. Nameplate legends.
 - 6. Size and number of bus bars and current rating for each bus, including mains and branches of phase, neutral, and ground buses.
 - 7. Short-time and short-circuit current ratings of secondary unit substations and components.

- 8. Ratings of individual protective devices.
- C. Time-Current Characteristic Curves: For overcurrent protective devices.
- D. Primary Fuses: Submit recommendations and size calculations.
- E. Coordination Drawings: Floor plans, reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Dimensioned concrete base, outline of secondary unit substation, conduit entries, and switchboard locations.
 - 2. Location of structural supports for structure-supported raceways.
 - 3. Location of lighting fixtures, sprinkler piping and heads, ducts, and diffusers.
- F. Product Certificates: For secondary unit substations, signed by product manufacturer.
- G. Qualification Data: For testing agency.
- H. Material Test Reports: For secondary unit substations.
- I. Factory test reports.
- J. Field quality-control test reports.
- K. Operation and Maintenance Data: For secondary unit substations and accessories to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Source Limitations: Obtain secondary unit substation through one source from a single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of secondary unit substations and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- D. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- E. Comply with IEEE C2.
- F. Comply with IEEE C37.121.
- G. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver in shipping splits in sizes that can be moved past obstructions in delivery path.
- B. Coordinate delivery of secondary unit substations to allow movement into designated space.
- C. Store secondary unit substation components protected from weather and so condensation will not form on or in units. Provide temporary heating according to manufacturer's written instructions.
- D. Handle secondary unit substation components according to manufacturer's written instructions. Use factory-installed lifting provisions.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Indicate measurements on Shop Drawings.
- B. Interruption of Existing electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Contracting Officer no fewer than two (2) days in advance of proposed interruption of electric service.
 - 2. Do not proceed with interruption of electric service without Contracting Officer's written permission.

1.8 COORDINATION

- A. Coordinate layout and installation of secondary unit substations with other construction that penetrates floors and ceilings, or is supported by them, including light fixtures, HVAC equipment, and fire-suppression-system components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. H.K. Scholz Co.
 - 2. Cooper Industries, Inc.; Cooper Power Systems Division.
 - 3. Cutler-Hammer.
 - 4. GE Electrical Distribution & Control.

5. Siemens Energy & Automation, Inc.
6. Square D; Schneider Electric.
7. E.A. Pederson Co.

2.2 MANUFACTURED UNITS

- A. Indoor Unit Arrangement: Single assembly.
- B. Enclosure Finish: Factory-applied finish in manufacturer's standard color, including under surfaces treated with corrosion-resistant undercoating.
- C. Secondary unit substation must have the ability to be provided 'broken down' such that it will fit through a 36-inch x 84-inch opening. Field assembly and field testing of the assembly may be required.

2.3 INCOMING SECTION

- A. Primary Incoming Section: Enclosed, front accessible, air-interrupter, primary switch.
 1. Three pole, single throw, dead front, metal enclosed, with manual stored energy operator, with fuses mounted on a single frame, complying with IEEE C37.20.3.
 2. Phase Barriers: Located between blades and fuses of each phase, designed for easy removal, allows visual inspection of switch components when barrier is in place.
 3. Window: Permits viewing switch-blade positions when door is closed.
 4. Accessory Set: Tools and miscellaneous items required for interrupter switchgear test, inspection, maintenance, and operation. Include fuse-handling tool as recommended by switchgear manufacturer.
 5. Continuous-Current Rating: 600 A.
 6. Short-Circuit Rating:
 - a. Short-time momentary asymmetrical fault rating of 40 kA.
 - b. 3-second symmetrical rating of 25-kA RMS.
 - c. Fault close asymmetrical rating of 40 kA.
 7. Fuses: Sizes recommended by secondary unit substation manufacturer, considering fan cooling, temperature-rise specification, and cycle loading. Comply with the following:
 - a. Current-limiting expulsion (CLE) type, rated for not less than 50-kA RMS symmetrical current-interrupting capacity.
 - b. Indicator integral with each fuse to show when it has blown.
 - c. Spares: Include three fuses in use and three spare fuses in storage clips in each switch.

2.4 DRY-TYPE TRANSFORMER SECTION

- A. Description: IEEE C57.12.51, NEMA ST 20, and dry-type, 2-winding, secondary unit substation transformer.
- B. Enclosure: Indoor, ventilated, vacuum-pressure, impregnated type and with insulation system rated at 220 deg C with an 80 deg C average winding temperature rise above a maximum ambient temperature of 40 deg C.
- C. Cooling System: Class FA, air cooled, complying with IEEE C57.12.01 sized to increase capacity by 33%.
 - 1. Automatic forced-air cooling system controls, including thermal sensors, fans, control wiring, temperature controller with test switch, power panel with current-limiting fuses, indicating lights, alarm, and alarm silencing relay.
- D. Insulation Materials: IEEE C57.12.01, rated 220 deg C.
- E. Insulation Temperature Rise: 80 deg C, maximum rise above 40 deg C.
- F. Basic Impulse Level: 95 kV.
- G. Full-Capacity Voltage Taps: 4 nominal 2.5 percent taps, 2 above and 2 below rated primary voltage.
- H. Sound level may not exceed 64 decibels, without fans operating.
- I. Impedance: 5.75% percent
- J. High-Temperature Alarm: Sensor at transformer with local audible and visual alarm and contacts for remote alarm.

2.5 SECONDARY DISTRIBUTION SECTION

- A. Secondary Distribution: Provide secondary side air terminal cabinet. See Switchboard Schedules for cable sizes.

2.6 IDENTIFICATION DEVICES

- A. Compartment Nameplates: Engraved, laminated-plastic or metal nameplate for each compartment, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 16 Section "Electrical Identification".

2.7 SOURCE QUALITY CONTROL

- A. Factory Tests: Perform design and routine tests according to standards specified for components. Conduct transformer tests according to IEEE C57.12.90. Conduct switchgear and switchboard tests according to ANSI C37.51.
- B. Factory Tests: Perform the following factory-certified tests on each secondary unit substation:

1. Resistance measurements of all windings on the rated voltage connection and on tap extreme connections.
2. Ratios on the rated voltage connection and on tap extreme connections.
3. Polarity and phase relation on the rated voltage connection.
4. No-load loss at rated voltage on the rated voltage connection.
5. Exciting current at rated voltage on the rated voltage connection.
6. Impedance and load loss at rated current on the rated voltage connection and on tap extreme connections.
7. Applied potential.
8. Induced potential.
9. Temperature Test: Transformer supplied with auxiliary cooling equipment to provide more than one rating, test at lowest kilovolt-ampere Class AA rating and highest kilovolt-ampere Class FA rating.
 - a. Temperature test is not required if a record of a temperature test on an essentially duplicate unit is available.
10. Contracting Officer will witness all required factory tests. Notify Contracting Officer at least 14 days before date of tests and indicate their approximate duration.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and space conditions for compliance with requirements for secondary unit substations and other conditions affecting performance of work.
- B. Examine roughing-in of conduits and grounding systems to verify the following:
 1. Wiring entries comply with layout requirements.
 2. Entries are within conduit-entry tolerances specified by manufacturer and no feeders will have to cross section barriers to reach load or line lugs.
- C. Examine walls, floors, roofs, and concrete bases for suitable conditions for secondary unit substation installation.
- D. Verify that ground connections are in place and that requirements in Division 16 Section "Grounding and Bonding" have been met. Maximum ground resistance shall be 5 ohms at secondary unit substation location.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install and connect unit substations furnished under this section as indicated on project drawings, the approved shop drawings, and as specified herein.
- B. Interrupter Switchgear:
 - 1. IEEE C37.20.3.
- C. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

3.3 IDENTIFICATION

- A. Identify field-installed wiring and components and provide warning signs as specified in Division 16 Section, Electrical Identification.
- B. Operating Instructions: Frame printed operating instructions for secondary unit substations, including interlocking, control sequences, elementary single-line diagram, and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of secondary unit substation.

3.4 CONNECTIONS

- A. Ground equipment according to Division 16.
- B. Connect wiring according to Division 16.

3.5 CLEANING

- A. After completing equipment installation and before energizing, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish. Vacuum interiors of secondary unit substation sections.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Testing: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:
- C. Perform the following field tests and inspections and prepare test reports:
 - 1. Perform each visual and mechanical inspection and electrical test according to NETA ATS. Certify compliance with test parameters.
 - 2. After installing secondary unit substation but before primary is energized, verify that grounding system at the substation tested at the specified value or less.
 - 3. After installing secondary unit substation and after electrical circuitry has been energized, test for compliance with requirements.

4. Set field-adjustable switches and circuit-breaker trip ranges.
 - a. Remove and replace malfunctioning units and retest as specified above.

D. Pre-Energization Services

1. Calibration, testing, adjustment, and placing into service of the installation shall be accomplished by a manufacturer's product field service engineer or independent testing company with a minimum of 2 years of current product experience. The following services shall be performed subsequent to testing but prior to the initial energization. The equipment shall be inspected to ensure that installation is in compliance with the recommendations of the manufacturer and as shown on the detail drawings. Terminations of conductors at major equipment shall be inspected to ensure the adequacy of connections. Bare and insulated conductors between such terminations shall be inspected to detect possible damage during installation. If factory tests were not performed on completed assemblies, tests shall be performed after the installation of completed assemblies. Components shall be inspected for damage caused during installation or shipment to ensure packaging materials have been removed. Components capable of being both manually and electrically operated shall be operating manually prior to the first electrical operation. Components capable of being calibrated, adjusted, and tested shall be calibrated, adjusted, and tested in accordance with the instruction of the equipment manufacturer.

3.7 FOLLOW-UP VERIFICATION

- A. Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. Test shall require each item to perform its function not less than three times. As an exception to requirements stated elsewhere in the contract, the Contracting Officer shall be given five (5) working days' advance notice of the dates and times for checks, settings, and tests.

END OF SECTION